

CLAIMS

1. A method, comprising:
  - providing a semiconductor substrate;
  - 5 forming a sacrificial layer overlying a first portion of the semiconductor substrate;
  - forming an oxide layer overlying a second portion of the semiconductor substrate;
  - forming a plurality of nanoclusters overlying the sacrificial layer and the oxide layer;
  - removing at least the plurality of nanoclusters overlying the sacrificial layer; and
  - removing the sacrificial layer.
- 10 2. The method of claim 1, wherein the semiconductor substrate comprises a periphery region and a nanocluster region, and wherein forming the sacrificial layer overlying the first portion of the semiconductor substrate comprises forming the sacrificial layer over the semiconductor substrate in the periphery region, and wherein forming the plurality
- 15 of nanoclusters comprises forming the plurality of nanoclusters over the sacrificial layer in the periphery region and over the semiconductor substrate in the nanocluster region.
3. The method of claim 2, wherein removing the at least a portion of the plurality of nanoclusters comprises removing the at least a portion of the plurality of nanoclusters
- 20 which overlies the sacrificial layer in the periphery region.
4. The method of claim 2, further comprising forming a nanocluster device in the nanocluster region and forming a non-nanocluster device in the periphery region.
- 25 5. The method of claim 1, wherein the sacrificial layer has a thickness of at least 10 nanometers.
6. The method of claim 1, wherein the sacrificial layer comprises at least one of a nitride or an oxide.
- 30 7. The method of claim 1, wherein the sacrificial layer comprises an oxide which etches faster than a thermal oxide.

8. The method of claim 1, wherein a material of the sacrificial layer is selected such that the plurality of nanoclusters are selectively removable with respect to the sacrificial layer.
- 5 9. The method of claim 1, wherein forming the sacrificial layer comprises depositing at least one of a nitride-containing layer over the semiconductor substrate, an oxide-containing layer over the semiconductor substrate, or a polysilicon-containing layer over the semiconductor substrate.
- 10 10. The method of claim 1, wherein the sacrificial layer comprises at least one of a pad oxide or a pad nitride.
11. The method of claim 10, wherein forming the sacrificial layer comprises:  
forming at least one of a pad oxide layer or a pad nitride layer over the semiconductor  
15 substrate; and  
forming isolation regions in the semiconductor substrate using the at least one of the pad oxide layer or the pad nitride layer.
12. The method of claim 1, further comprising:  
20 performing a clean after removing the at least a portion of the plurality of nanoclusters and prior to removing the sacrificial layer.
13. The method of claim 12 further comprising:  
implementing the clean with a composition that has a basic pH to overcome  
25 electrostatic attraction of the plurality of nanoclusters to the sacrificial layer and to the semiconductor substrate.
14. The method of claim 12 further comprising:  
implementing the clean with a mechanical action to remove the plurality of  
30 nanoclusters from the sacrificial layer and from the semiconductor substrate.

15. A method, comprising:
- providing a semiconductor substrate having a periphery region and a nanocluster region;
- 5 depositing a first sacrificial layer over the semiconductor substrate in the periphery region and in the nanocluster region;
- removing a portion of the first sacrificial layer in the nanocluster region;
- forming an insulating layer over the semiconductor substrate in the nanocluster region;
- 10 forming a plurality of nanoclusters over the semiconductor substrate, wherein the plurality of nanoclusters is formed over a remaining portion of the first sacrificial layer in the periphery region and over the insulating layer in the nanocluster region;
- forming a patterned masking layer over the plurality of nanoclusters in the nanocluster region; and
- 15 removing the plurality of nanoclusters which overlie the first sacrificial layer in the periphery region and the remaining portion of the first sacrificial layer.
16. The method of claim 15, further comprising forming a second sacrificial layer over the semiconductor substrate, wherein depositing the first sacrificial layer comprises
- 20 depositing the first sacrificial layer over the second sacrificial layer.
17. The method of claim 16, wherein the first sacrificial layer comprises at least one of a nitride or an oxide, and wherein the second sacrificial layer comprises an oxide.
- 25 18. The method of claim 15, wherein removing the plurality of nanoclusters which overlie the first sacrificial layer in the periphery region and the remaining portion of the first sacrificial layer comprises:
- performing a clean after removing the plurality of nanoclusters which overlie
- 30 the first sacrificial layer in the periphery region and prior to removing the remaining portion of the first sacrificial layer.

19. The method of claim 15, further comprising forming a nanocluster device in the nanocluster region using at least a portion of the plurality of nanoclusters over the insulating layer in the nanocluster region and forming a non-nanocluster device in the periphery region.

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20. A method, comprising:

providing a semiconductor substrate having a periphery region and a nanocluster region;

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forming a first pad layer over the semiconductor substrate in the periphery region and in the nanocluster region;

forming isolation regions in the semiconductor substrate using the first pad layer, wherein the isolation regions extend through the first pad layer into the semiconductor substrate;

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removing a portion of the first pad layer in the nanocluster region;

forming an insulating layer over the semiconductor substrate in the nanocluster region;

forming a plurality of nanoclusters over the semiconductor substrate, wherein the plurality of nanoclusters is formed over a remaining portion of the first pad layer in the periphery region and over the insulating layer in the nanocluster region;

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forming a patterned masking layer over the plurality of nanoclusters in the nanocluster region; and

removing the plurality of nanoclusters which overlie the first pad layer in the periphery region and the remaining portion of the first pad layer.

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21. The method of claim 20, further comprising forming a second pad layer over the semiconductor substrate in the periphery region and in the nanocluster region, wherein the first pad layer is formed over the second pad layer, and wherein forming isolation regions comprises:

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forming isolation regions in the semiconductor substrate using the first and second pad layers, wherein the isolation regions extend through the first and second pad layers into the semiconductor substrate.

22. The method of claim 20, further comprising:  
removing a portion of the second pad layer in the nanocluster region prior to forming  
the insulating layer, and  
5 removing a remaining portion of the second pad layer in the periphery region after  
removing the plurality of nanoclusters.
23. The method of claim 20, wherein the first pad layer comprises a nitride and the second  
pad layer comprises an oxide.  
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24. The method of claim 20, further comprising forming a second pad layer over the first  
pad layer in the periphery region and in the nanocluster region, wherein forming  
isolation regions comprises:  
forming isolation regions in the semiconductor substrate using the first pad layer and  
15 the second pad layer, wherein the isolation regions extend through the first pad  
layer and the second pad layer into the semiconductor substrate.
25. The method of claim 24, further comprising:  
removing the second pad layer in the periphery region and in the nanocluster region  
20 prior to removing the portion of the first pad layer in the nanocluster region.
26. The method of claim 24, wherein the first pad layer comprises an oxide and the second  
pad layer comprises a nitride.
- 25 27. The method of claim 20, wherein the first pad layer comprises at least one of an oxide  
or a nitride.
28. The method of claim 20, wherein removing the plurality of nanoclusters which overlie  
the first pad layer in the periphery region and the remaining portion of the first pad  
30 layer comprises:  
performing a clean after removing the plurality of nanoclusters which overlie the first  
pad layer in the periphery region and prior to removing the remaining portion of  
the first pad layer.

29. The method of claim 20, further comprising forming a nanocluster device in the nanocluster region using at least a portion of the plurality of nanoclusters over the insulating layer in the nanocluster region and forming a non-nanocluster device in the periphery region.

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